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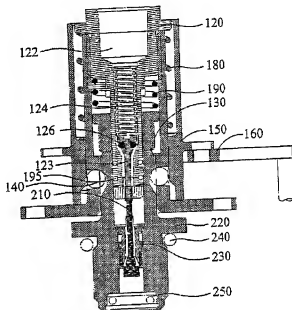
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(54) DISPOSITIF DE PRISE RAPIDE POUR CARTOUCHE D'HYDROGENE

(54) RAPID COUPLING DEVICE FOR HYDROGEN STORAGE CANISTER

(57)

A rapid coupling device for a hydrogen storage canister. The rapid coupling device communicates the hydrogen storage canister and a fuel cell. The hydrogen storage canister includes a connecting assembly. The rapid coupling device includes a base and a communicating member. The communicating member communicates with the fuel cell, and is connected to the base. When the hydrogen storage canister is coupled to the fuel cell via the connecting assembly, the communicating member is abutted by the connecting assembly so that hydrogen in the hydrogen storage canister flows to the fuel cell through the connecting assembly and the communicating member.



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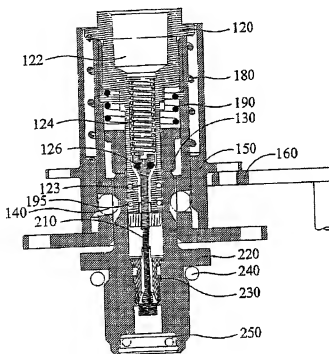
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(54) Titre : DISPOSITIF DE PRISE RAPIDE POUR CARTOUCHE D'HYDROGENE

(54) Title: RAPID COUPLING DEVICE FOR HYDROGEN STORAGE CANISTER



(57) Abrégé/Abstract:

A rapid coupling device for a hydrogen storage canister. The rapid coupling device communicates the hydrogen storage canister and a fuel cell. The hydrogen storage canister includes a connecting assembly. The rapid coupling device includes a base and a communicating member. The communicating member communicates with the fuel cell, and is connected to the base. When the hydrogen storage canister is coupled to the fuel cell via the connecting assembly, the communicating member is abutted by the connecting assembly so that hydrogen in the hydrogen storage canister flows to the fuel cell through the connecting assembly and the communicating member.

ABSTRACT OF THE DISCLOSURE

A rapid coupling device for a hydrogen storage canister. The rapid coupling device communicates the hydrogen storage canister and a fuel cell. The hydrogen storage canister includes a connecting assembly. The rapid coupling device includes a base and a communicating member. The communicating member communicates with the fuel cell, and is connected to the base. When the hydrogen storage canister is coupled to the fuel cell via the connecting assembly, the communicating member is abutted by the connecting assembly so that hydrogen in the hydrogen storage canister flows to the fuel cell through the connecting assembly and the communicating member.

TITLE

RAPID COUPLING DEVICE FOR HYDROGEN STORAGE CANISTER

BACKGROUND OF THE INVENTION

Field of the Invention

5 The invention relates to a connecting device for a hydrogen storage canister and a rapid coupling device therein; in particular, to a connecting device that can conveniently detach the hydrogen storage canister.

Description of the Related Art

10 Recently, air pollution is more severe, and most of it comes from exhaust gas generated by gasoline engines. Thus, the pollution generated by the gasoline engine is worthy of consideration. To improve environmental quality, it is important to replace polluting gasoline
15 engines with non-polluting fuel cells.

 The structure and types of fuel cells are less relevant with this invention, their detailed description is omitted. Currently, fuel cells can be applied in many areas including the aerospace and military, power
20 generation, and transportation areas. It is noted that fuel cells operate by combining oxygen and hydrogen, wherein oxygen is directly provided by the environment, and hydrogen is usually supplied by a hydrogen storage canister containing pure hydrogen.

25 Since fuel cells and their peripheral equipment are still undergoing research, the technology is immature. For example, when a fuel cell is placed in an engine module of an electric scooter, the hydrogen storage

canister must communicate with the fuel cell via a connecting device. Conventionally, a commercial quick connection device is used. Commercial quick connection devices, however, have the following disadvantages. The large size of a commercial quick connection device requires the fuel cell to occupy more space. The operation of a commercial quick connection device requires two steps, it is difficult to detach. Additionally, the commercial quick connection device is detached by rotation, and the device therein is easily damaged.

SUMMARY OF THE INVENTION

In view of this, the invention provides a rapid coupling connecting device for a hydrogen storage canister that conveniently detaches from the hydrogen storage canister.

Accordingly, the invention provides a rapid coupling device for a hydrogen storage canister. The rapid coupling device communicates the hydrogen storage canister and a fuel cell. The hydrogen storage canister includes a connecting assembly. The rapid coupling device includes a base and a communicating member. The communicating member communicates with the fuel cell, and is connected to the base. When the hydrogen storage canister is coupled to the fuel cell via the connecting assembly, the communicating member is abutted by the connecting assembly so that hydrogen in the hydrogen storage canister flows to the fuel cell through the connecting assembly and the communicating member.

In a preferred embodiment, the rapid coupling device further includes a moving member, an abutting member, and a separating member. The moving member is disposed in the base in a manner such that the moving member moves between a first position and a second position. The abutting member is moveably disposed on the base. When the moving member is located at the first position, the abutting member is abutted by the moving member. When the moving member is located at the second position, the abutting member is abutted by the connecting assembly. The separating member is disposed on the base in a manner such that the separating member moves between a third position and a fourth position. When the separating member is located at the third position, the abutting member is abutted by the connecting assembly. When the separating member is located at the fourth position, the abutting member is not abutted by the connecting assembly.

Furthermore, the abutting member is a steel ball, and the base is formed with a through hole in which the abutting member is disposed.

The rapid coupling device further includes an extension member, a rod, a first elastic member, and a second elastic member. The extension member is connected to the separating member, and the rod is connected to the extension member. The first elastic member, surrounding the base, is abutted by the separating member and the communicating member respectively so as to move the separating member between the third position and the fourth position. The second elastic member, surrounding

the communicating member, is abutted by the moving member and the communicating member respectively so as to move the moving member between the first position and the second position.

5 In another preferred embodiment, the communicating member includes a groove, and the rapid coupling device further includes a first seal member disposed in the groove.

10 In another preferred embodiment, the communicating member is formed with a hollow portion communicating with the fuel cell, and includes an ejector member, a third elastic member, and a second seal member. The ejector member is moveably disposed in the hollow portion of the communicating member to control the communication between
15 the outside and the hollow portion of the communicating member. The third elastic member is disposed in the hollow portion in a manner such that the third elastic member is abutted by the ejector member, and maintains the ejector member at a predetermined position. The
20 second seal member is disposed on the ejector member to seal the ejector member and the hollow portion.

In this invention, a connecting device for communicating a hydrogen storage canister and a fuel cell is provided. The connecting device includes a first
25 connecting assembly and a second connecting assembly. The first connecting assembly communicates with the fuel cell, and includes a base and a communicating member connected to the base. The second connecting assembly includes a first ejector member, and is disposed in the
30 hydrogen storage canister and connected to the first

connecting assembly in a detachable manner. When the second connecting assembly is connected to the first connecting assembly, the communicating member is abutted by the first ejector member so that hydrogen in the hydrogen storage canister flows to the fuel cell through the second connecting assembly and the first connecting assembly.

In a preferred embodiment, the second connecting assembly further includes a body, a valve, and a seal member. The body includes a concave portion, and is disposed in the hydrogen storage canister. The valve is disposed in the body, and the first ejector member is moveably disposed in the valve. The seal member is disposed in the concave portion.

In this invention, another rapid coupling device for a hydrogen storage canister including a connecting assembly is provided. The rapid coupling device includes a base and a communicating member. The communicating member is connected to the base. When the hydrogen storage canister is coupled to the rapid coupling device via the connecting assembly, the communicating member is abutted by the connecting assembly so that hydrogen in the hydrogen storage canister flows to the rapid coupling device through the connecting assembly and the communicating member.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention can be more fully understood by reading the subsequent detailed description and

examples with references made to the accompanying drawings, wherein:

Fig. 1a is an exploded view of a connecting device for a hydrogen storage canister as disclosed in this invention;

Fig. 1b is a top view of the connecting device as shown in Fig. 1a;

Fig. 2a is a cross section of the connecting device in Fig. 1a, wherein a first connecting assembly is not connected to a second connecting assembly;

Fig. 2b is a cross section of the connecting device in Fig. 1a, wherein the first connecting assembly is connected to the second connecting assembly;

Fig. 2c is a cross section of the connecting device in Fig. 1a, wherein a separating member is moved to a fourth position;

Fig. 3 is a schematic view of the connecting device assembled on a hydrogen storage canister; and

Fig. 4 is a schematic view of an embodiment of the second connecting assembly as disclosed in this invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Fig. 1a and Fig. 2a, a connecting device 1 as disclosed in this invention is provided, and is used for communicating a hydrogen storage canister 400 and a fuel cell 300. The connecting device 1 includes a first connecting assembly 100 and a second connecting assembly 200. The first connecting assembly 100 is used

as a rapid coupling device for the hydrogen storage canister 400 as disclosed in this invention.

As shown in Fig. 1a and Fig. 2a, the first connecting assembly 100 communicates with the fuel cell 300, and includes a base 110, a communicating member 120, a moving member 130, a plurality of abutting members 140, a separating member 150, an extension member 160, a rod 170, a first elastic member 180, a second elastic member 190, and two first seal members 195. It is noted that only one abutting member 140 is shown in Fig. 1a.

The base 110 is used as a body of the first connecting assembly 100, and is formed with a plurality of fixed holes 112 so as to be fixed. In addition, the base 110 is formed with a plurality of through holes 111 in which the abutting members 140 are disposed. It is noted that only one through hole 111 is shown in Fig. 1a.

The communicating member 120 is connected to the base 110, and is formed with two grooves 121 in which the first seal members 195 are disposed. The communicating member 120 is formed with a hollow portion 122 as shown in Fig. 2a, and includes a first ejector member 123, a third elastic member 124, and a second seal member 126. The hollow portion 122 communicates with the fuel cell 300. The first ejector member 123 is moveably disposed in the hollow portion 122 of the communicating member 120 to control the communication between the outside and the hollow portion 122 of the communicating member 120. The third elastic member 124 is disposed in the hollow portion 122 in a manner such that the third elastic member 124 is abutted by the first ejector member 123,

and maintains the first ejector member 123 at a predetermined position. It is understood that the third elastic member 124 may be a compression spring. The second seal members 126 are disposed on the first ejector member 123 to seal the first ejector member 123 and the hollow portion 122. Thus, the communicating member 120 may be used as a channel communicating the outside and the first connecting assembly 100.

The moving member 130 is disposed in the base 110 and one end of the moving member 130 is projected from the communicating member 130. When the second connecting assembly 200 is not connected to the first connecting assembly 100, the moving member 130 is located at a position as shown in Fig. 2a (hereinafter referred to as a first position) so as maintain the abutting member 140 at a predetermined position. When the second connecting assembly 200 is connected to the first connecting assembly 100, the moving member 130 is located at a position as shown in Fig. 2b (hereinafter referred to as a second position) so that the abutting member 140 is away from the predetermined position and may move in a predetermined range.

Each of the abutting members 140 is disposed in the through holes 111 of the base 110 in a manner such that it is moved in a predetermined range. When the first connecting assembly 100 is inserted by the second connecting assembly 200, the second connecting assembly 200 is fixed in the first connecting assembly 100 by the abutting members 140. It is understood that each of the abutting members 140 may be a steel ball as shown in Fig.

1a. Furthermore, as shown in Fig. 2a, when the moving member 130 is located at the first position, the abutting member 140 is abutted by the moving member 130. When the moving member 130 is located at the second position, the abutting member 140 is abutted by a body 220 of the second connecting assembly 200.

The separating member 150 is moveably disposed on the base 110, and separates the second connecting assembly 200 from the first connecting assembly 100. When the second connecting assembly 200 is connected to the first connecting assembly 100, the separating member 150 is located at a position as shown in Fig. 2b (hereinafter referred to as a third position) so as to be abutted by the abutting members 140. Thus, the abutting members 140 are abutted by the second connecting assembly 200 so that the second connecting assembly 200 is kept in the first connecting assembly 100. When the second connecting assembly 200 is separated from the first connecting assembly 100, the separating member 150 is moved upward so as to be located at a position as shown in Fig. 2c (hereinafter referred to as a fourth position). At this time, since the separating member 150 is moved upward, the abutting members 140 are moved outward. Thus, the second connecting assembly 200 cannot be abutted by the abutting members 140 so that the second connecting assembly 200 cannot be kept in the first connecting assembly 100. As a result, the second connecting assembly 200 can be separated from the first connecting assembly 100.

The extension member 160 is connected to the separating member 150, and the rod 170 is connected to the extension member 160. By means of the extension member 160 and the rod 170, the separating member 150 can be easily operated by the user.

As shown in Fig. 2b and Fig. 2c, the first elastic member 180 surrounds the base 110. The first elastic member 180 is abutted by the separating member 150 and the communicating member 120 respectively so as to move the separating member 150 between the third position and the fourth position. It is noted that the first elastic member 160 may be a compression spring.

As shown in Fig. 2a and Fig. 2b, the second elastic member 190 surrounds the communicating member 120, and is abutted by the moving member 130 and the communicating member 120 respectively so as to move the moving member 130 between the first position and the second position. It is noted that the second elastic member 190 may be a compression spring.

The first seal members 195 are disposed in the grooves 121 of the communicating member 120, and prevent air from entering through a gap between the communicating member 120 and the moving member 130. Each of the first seal members 195 may be an O-ring.

Referring to Fig. 1a and Fig. 2a, the second connecting assembly 200 is disposed in the hydrogen storage canister 400 and communicates with the hydrogen storage canister 400, and is connected to the first connecting assembly 100 in a detachable manner. The second connecting assembly 200 includes a body 220, a

valve 230, a second ejector member 210, a third seal member 240, and a filter member 250.

5 The body 220 is used as a main component of the second connecting assembly 200, and is formed with a concave portion 221 in which the third seal member 240 is disposed. The valve 230 is disposed in the body 220, and the second ejector member 210 is moveably disposed in the valve 230. The third seal member 240 is disposed in the concave portion 221 of the body 220 so as to seal the
10 second connecting assembly 200 and the hydrogen storage canister 400. The filter member 250 is disposed in the body 220, and filters hydrogen passing through the second connecting assembly 200.

15 It is noted that the second ejector member 210 is kept in the valve 230 by an elastic member (not shown).

Referring to Fig. 3, the connecting device 1 is assembled on the hydrogen storage canister 400. Specifically, the second connecting assembly 200 is disposed in a container 500 of the hydrogen storage
20 canister 400.

Furthermore, referring to Fig. 4, the connecting device 1 further includes a cover 260. When the second connecting assembly 200 is not connected to the first connecting assembly 100, the cover 260 is disposed on the
25 second connecting assembly 200 so as to protect the second connecting assembly 200 on the hydrogen storage canister 400. In addition, since the cover 260 may be made of plastic that is lighter material, it can detect whether hydrogen in the hydrogen storage canister 40 has
30 improperly leaked out. Specifically, when the hydrogen

storage canister 400 is subjected to improper treatment so that received hydrogen leaks out, the cover 260 will be separated from the second connecting assembly 200. Thus, an abnormal situation may be easily observed by the user.

The structure of the connecting device 1 is described above, and its operation is described as follows referring to Figs. 2a-2c.

To connect the second connecting assembly 200 and the first connecting assembly 100, the body 220 is first abutted by the communicating member 120 as shown in Fig. 2a while the second ejector member 210 is not abutted by the communicating member 120. Then, the body 220 is moved upward to press the second elastic spring 190 via the moving member 130 until the second ejector member 210 is abutted by the first ejector member 123 of the communicating member 120 as shown in Fig. 2b. At this time, since the second ejector member 210 is abutted by the first ejector member 123, a gap is formed between the second ejector member 210 and the valve 230. Also, the second seal member 126 is separated from the inner wall of the communicating member 120. Thus, hydrogen in the hydrogen storage canister 400 can pass through the gap between the valve 230 and the second ejector member 210 and flow to the fuel cell 300 through the hollow portion 122 of the communicating member 120. Finally, the abutting members 140 are moved inward so as to be abutted by the body 220, and the second connecting assembly 200 is kept in the first connecting assembly 100.

To separate the second connecting assembly 200 from the first connecting assembly 100, the separating member 150 is moved upward to press the first elastic member 180 as shown in Fig. 2c. At this time, the abutting members 140 can be moved outward due to the movement of the separating member 150, and it is separated from body 220. Thus, the second connecting assembly 200 can be separated from the first connecting assembly 100. It is noted that the first ejector member 123 can be pressed back to a fixed position by the third elastic member 124 at this time, and the second seal member 126 can be abutted by the inner wall of the communicating member 120 again. Thus, ambient air can be prevented from entering the communicating member 120.

The connecting device of this invention has the following advantages. Since the connecting device of this invention is designed for a hydrogen storage canister and fuel cell, its size can be minimized. Thus, the space required by the fuel cell can be minimized. Since the hydrogen storage canister can be separated from the fuel cell by simply moving the separating member, it is conveniently detached. Since the detachment is performed in a linear manner without rotation, the device therein avoids damage.

It is understood that the fuel cell is used as an object that the hydrogen storage canister supplies in this description. However, in practice, it is not limited to this; that is the connecting device of this invention can be applied to other equipment that requires a hydrogen storage canister to supply hydrogen.

While the invention has been described by way of example and in terms of the preferred embodiments, it is to be understood that the invention is not limited to the disclosed embodiments. To the contrary, it is intended to cover various modifications and similar arrangements (as would be apparent to those skilled in the art). Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.

What is claimed is:

1 1. A rapid coupling device for communicating a
2 hydrogen storage canister and a fuel cell, wherein the
3 hydrogen storage canister includes a connecting assembly
4 and the rapid coupling device comprises:

5 a base; and

6 a communicating member, communicating with the fuel
7 cell, connected to the base, wherein the
8 communicating member is abutted by the
9 connecting assembly so that hydrogen in the
10 hydrogen storage canister flows to the fuel
11 cell through the connecting assembly and the
12 communicating member when the hydrogen storage
13 canister is coupled to the fuel cell via the
14 connecting assembly.

1 2. The rapid coupling device as claimed in claim
2 1, further comprising:

3 a moving member disposed in the base in a manner
4 such that the moving member moves between a
5 first position and a second position;

6 an abutting member moveably disposed on the base,
7 wherein the abutting member is abutted by the
8 moving member when the moving member is located
9 at the first position, and the abutting member
10 is abutted by the connecting assembly when the
11 moving member is located at the second
12 position; and

a separating member disposed on the base in a manner such that the separating member moves between a third position and a fourth position, wherein the abutting member is abutted by the connecting assembly when the separating member is located at the third position, and the abutting member is not abutted by the connecting assembly when the separating member is located at the fourth position.

3. The rapid coupling device as claimed in claim 2, wherein the abutting member is a steel ball.

4. The rapid coupling device as claimed in claim 2, wherein the base is formed with a through hole in which the abutting member is disposed.

5. The rapid coupling device as claimed in claim 2, further comprising:

an extension member connected to the separating member; and
a rod connected to the extension member.

6. The rapid coupling device as claimed in claim 2, further comprising:

a first elastic member, surrounding the base, abutted by the separating member and the communicating member respectively so as to move the separating member between the third position and the fourth position.

1 7. The rapid coupling device as claimed in claim
2 2, further comprising:

3 a second elastic member, surrounding the
4 communicating member, abutted by the moving
5 member and the communicating member
6 respectively so as to move the moving member
7 between the first position and the second
8 position.

1 8. The rapid coupling device as claimed in claim
2 1, wherein the communicating member includes a groove,
3 and the rapid coupling device further comprises a first
4 seal member disposed in the groove.

1 9. The rapid coupling device as claimed in claim
2 1, wherein the communicating member is formed with a
3 hollow portion communicating with the fuel cell, and
4 comprises:

5 an ejector member, moveably disposed in the hollow
6 portion of the communicating member, for
7 controlling the communication between the
8 outside and the hollow portion of the
9 communicating member;

10 a third elastic member, disposed in the hollow
11 portion in a manner such that the third elastic
12 member is abutted by the ejector member, for
13 maintaining the ejector member at a
14 predetermined position; and

15 a second seal member, disposed on the ejector
16 member, for sealing the ejector member and the
17 hollow portion.

1 10. A connecting device for communicating a
2 hydrogen storage canister and a fuel cell, comprising:

3 a first connecting assembly, communicating with the
4 fuel cell, including a base and a communicating
5 member connected to the base; and

6 a second connecting assembly, including a first
7 ejector member, disposed in the hydrogen
8 storage canister and connected to the first
9 connecting assembly in a detachable manner,
10 wherein the communicating member is abutted by
11 the first ejector member so that hydrogen in
12 the hydrogen storage canister flows to the fuel
13 cell through the second connecting assembly and
14 the first connecting assembly when the second
15 connecting assembly is connected to the first
16 connecting assembly.

1 11. The connecting device as claimed in claim 10,
2 wherein the first connecting assembly further comprises:

3 a moving member disposed in the base in a manner
4 such that the moving member moves between a
5 first position and a second position;

6 an abutting member moveably disposed on the base,
7 wherein the abutting member is abutted by the
8 moving member when the moving member is located
9 at the first position, and the abutting member
10 is abutted by the second connecting assembly

when the moving member is located at the second position; and

a separating member disposed on the base in a manner such that the separating member moves between a third position and a fourth position, wherein the abutting member is abutted by the second connecting assembly when the separating member is located at the third position, and the abutting member is not abutted by the second connecting assembly when the separating member is located at the fourth position.

12. The connecting device as claimed in claim 11, further comprising:

a first elastic member, surrounding the base, abutted by the separating member and the communicating member respectively so as to move the separating member between the third position and the fourth position; and

a second elastic member, surrounding the communicating member, abutted by the moving member and the communicating member respectively so as to move the moving member between the first position and the second position.

13. The connecting device as claimed in claim 10, wherein the communicating member is formed with a hollow portion communicating with the fuel cell, and comprises:

a second ejector member, moveably disposed in the hollow portion of the communicating member, for

controlling the communication between the outside and the hollow portion of the communicating member;

a third elastic member, disposed in the hollow portion in a manner such that the third elastic member is abutted by the second ejector member, for maintaining the second ejector member at a predetermined position; and

a first seal member, disposed on the second ejector member, for sealing the second ejector member and the hollow portion.

14. The connecting device as claimed in claim 10, wherein the second connecting assembly further comprises:

a body, including a concave portion, disposed in the hydrogen storage canister;

a valve disposed in the body, wherein the first ejector member is moveably disposed in the valve; and

a second seal member disposed in the concave portion.

15. A rapid coupling device for a hydrogen storage canister including a connecting assembly, comprising:

a base; and

a communicating member connected to the base, wherein the communicating member is abutted by the connecting assembly so that hydrogen in the hydrogen storage canister flows through the rapid coupling device through the connecting assembly and the communicating member when the

hydrogen storage canister is coupled to the rapid coupling device via the connecting assembly.

16. The rapid coupling device as claimed in claim 15, further comprising:

a moving member disposed in the base in a manner such that the moving member moves between a first position and a second position;

an abutting member moveably disposed on the base, wherein the abutting member is abutted by the moving member when the moving member is located at the first position, and the abutting member is abutted by the connecting assembly when the moving member is located at the second position; and

a separating member disposed on the base in a manner such that the separating member moves between a third position and a fourth position, wherein the abutting member is abutted by the connecting assembly when the separating member is located at the third position, and the abutting member is not abutted by the connecting assembly when the separating member is located at the fourth position.

17. The rapid coupling device as claimed in claim 16, further comprising:

an extension member connected to the separating member; and

a rod connected to the extension member.

1 18. The rapid coupling device as claimed in claim
2 16, further comprising:

3 a first elastic member, surrounding the base,
4 abutted by the separating member and the
5 communicating member respectively so as to move
6 the separating member between the third
7 position and the fourth position; and

8 a second elastic member, surrounding the
9 communicating member, abutted by the moving
10 member and the communicating member
11 respectively so as to move the moving member
12 between the first position and the second
13 position.

1 19. The rapid coupling device as claimed in claim
2 15, wherein the communicating member includes a groove,
3 and the rapid coupling device further comprises a first
4 seal member disposed in the groove.

1 20. The rapid coupling device as claimed in claim
2 15, wherein the communicating member is formed with a
3 hollow portion, and comprises:

4 an ejector member, moveably disposed in the hollow
5 portion of the communicating member, for
6 controlling the communication between the
7 outside and the hollow portion of the
8 communicating member;

9 a third elastic member, disposed in the hollow
10 portion in a manner such that the third elastic
11 member is abutted by the ejector member, for

12 maintaining the ejector member at a
13 predetermined position; and
14 a second seal member, disposed on the ejector
15 member, for sealing the ejector member and the
16 hollow portion.

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Patent Agents**

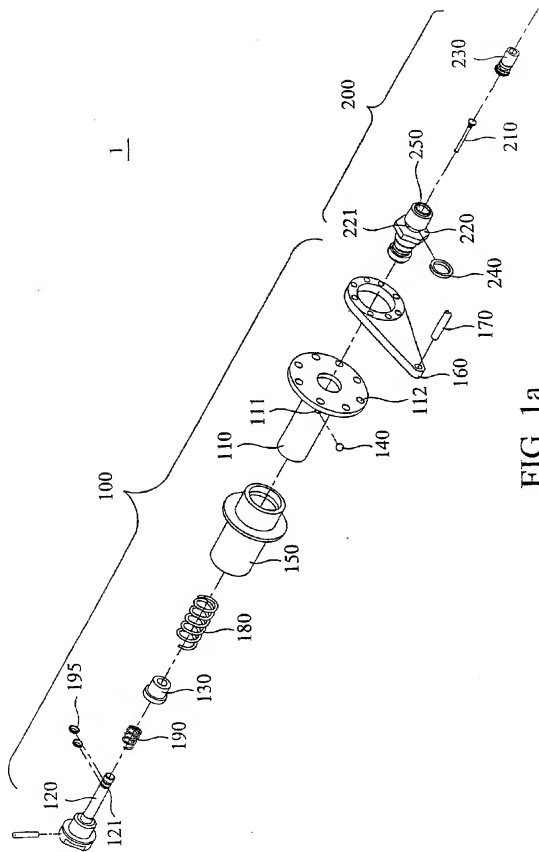


FIG. 1a

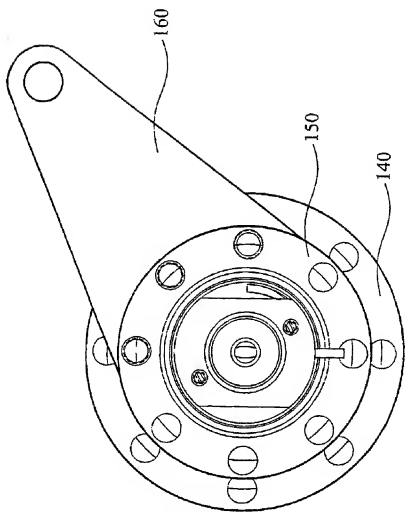


FIG. 1b

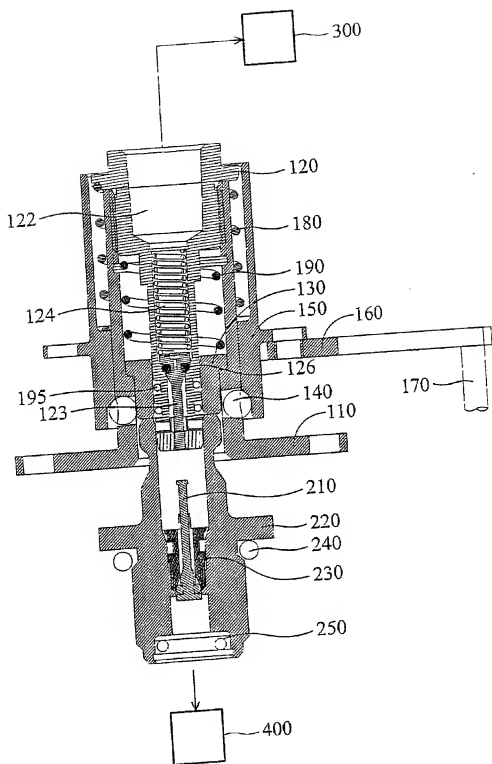


FIG. 2a

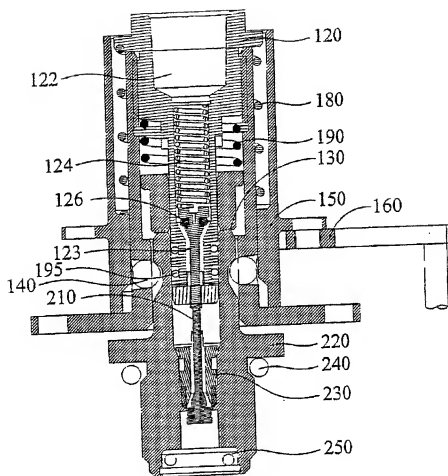


FIG. 2b

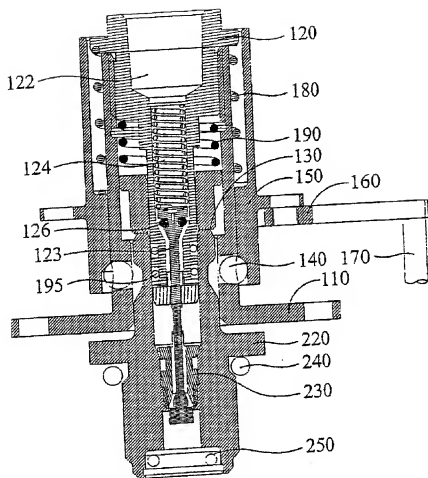


FIG. 2c

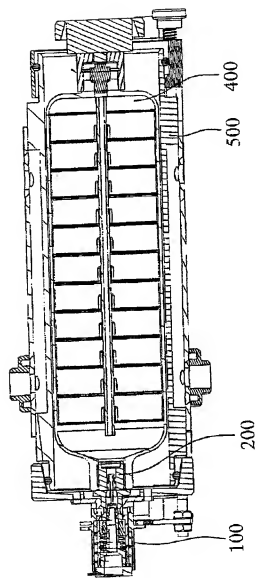


FIG. 3

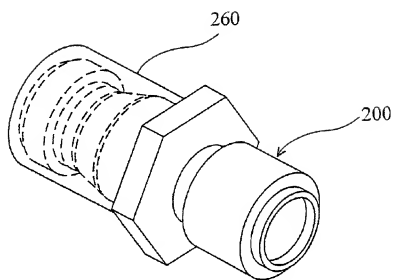


FIG. 4